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Ecological Insights into Butterfly Diversity and Habitat Preference: A Study from Acharya Prafulla Chandra College Campus

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Abstract: Butterflies are well known for their ecological services as good pollinators and bioindicators of ecosystem health. The current study examined the diversity and abundance of butterflies on the Acharya Prafulla Chandra College campus between November and March. A total of 36 species from 5 families were identified. The family Lycaenidae contributed the most species (13), while Hesperiidae only had two. The family Pieridae (34%) displayed the highest abundance count, indicating its dominance within the assemblage, followed by Lycaenidae (24.7%), Nymphalidae (20.7%), Papilionidae (18.7%), and Hesperiidae (1.8%). Species were categorized as rare, regular, or abundant, with community structure reflecting the coexistence of a few dominant taxa alongside several rare ones. Diversity peaked in November (H′ = 3.355, Simpson 1–D = 0.9602), which corresponded with favorable floral resources, demonstrating seasonal variation. Rank abundance curves showed a log-normal distribution of species, indicating ecological stability, and rarefaction analysis validated sufficient sampling effort. NMDS showed distinct clustering and separation of butterfly assemblages across habitat types, reflecting habitat heterogeneity. Pieridae and Nymphalidae occupied multiple habitats, whereas Lycaenidae and Papilionidae were associated with specific vegetation, particularly nectar-rich ornamental gardens. Overall, the results provide baseline data for long-term monitoring and conservation plans, highlighting the significance of the college campus's semi-urban landscape as a butterfly habitat.

Introduction

Butterflies are among the most extensively studied insect groups due to their ecological importance, visual attractiveness. They are often considered important indicators of ecological health and providers of ecosystem services as pollinators and also part of the food web (Ghazanfar et al., 2016; Saraf & Vijaykumar, 2020; Segre et al., 2023; Antil et al., 2025). The butterfly life cycle demonstrates a significant reliance on particular host plants during the larval stage and nectar sources in the adult stage, indicating a prolonged evolutionary relationship with plants (Bonebrake et al., 2010; Jaeger et al., 2025; Hanberry, 2025). Assessing their diversity and abundance offers an essential understanding of habitat quality, resource distribution and the ecological equilibrium in both managed and natural landscapes (Thomas, 2005). Diversity indices underscore the richness and evenness of butterfly communities, whereas abundance data indicate species dominance and seasonal variations—collectively establishing the foundation for evaluating ecosystem health and conservation priorities (Sharma & Joshi, 2009). Investigations conducted in various biogeographic regions of India have demonstrated significant seasonal fluctuations in butterfly

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Figure 1. Location of the study site (Acharya Prafulla Chandra College campus) as shown by the Google Map.

populations, with maximum diversity frequently observed during the monsoon and post-monsoon periods when floral resources are plentiful, while the winter season has consistently decreased butterfly diversity primarily attributed to cold temperatures and diminished floral phenology (Kunte, 2000). Even though resources are limited in the winter, urban green areas and institutional gardens can still provide unique habitats that keep butterfly groups alive. These places are often very important due to the nectar-rich flowering plants, shelter and small environments that help them in foraging and reproduction (Tiple et al., 2007; Raut & Pendharkar, 2010). Studies focusing specifically on butterfly diversity in semi-urban institutional gardens of eastern India during winter are limited, leaving gaps in understanding how ornamental landscapes contribute to the persistence of butterfly communities under seasonal constraints.

The present study addresses documenting the diversity and abundance of butterfly species in the ornamental gardens of Acharya Prafulla Chandra College, New Barrackpore, West Bengal, in winter. The study site is particularly significant because the college garden experiences a peak blooming phase in January as part of preparations for the Annual Pushpa Mela organized by the New Barrackpore Municipality. Such blossoming episodes may produce transient nectar-rich environments that support butterfly populations, though available literature indicates decreased butterfly activity during the winter. The study emphasizes the ecological significance of institutional green areas as butterfly diversity reservoirs by studying this seasonal assemblage. These results will advance knowledge of butterfly ecology in urban and semi-urban environments as well as local conservation and awareness.

Methodology

Study Area

The study was carried out at Acharya Prafulla Chandra College, situated in New Barrackpore, North 24 Parganas, West Bengal (22°41′51.08″N & 88°26′16.34″E). The college campus covers approximately 7.5 acres and is bordered by semi-urban residential and institutional developments. The campus is surrounded by a lot of concrete buildings, but it also has a lot of different types of plants, such as big trees along the shady areas, bushy areas, open grasslands, a pond ecosystem, a playground, and well-kept ornamental and medicinal gardens. Six habitat categories were identified: Built-up (BU – concrete buildings, basketball courts, and paved spaces), Ornamental Garden (OG – flower beds, ornamental plants, vegetable plants, and decorative patches), Medicinal Garden (MG – medicinal plants and herbal garden), Grassland (GR – open grassy patches and fields), Shrubland (SH – low shrubs, bushes), and Wetland (WL – Pond, wet grass near pond, moist edges).

A wide variety of flowering plants are nurtured on the campus, including different species of roses (*Rosa* spp.), sunflowers (*Helianthus annuus*), dahlias (*Dahlia* spp.), chrysanthemums (*Chrysanthemum* spp.), marigolds (*Tagetes* spp.), daisies (*Bellis perennis*), and gerberas (*Gerbera* spp.), which offer plenty of nectar resources for butterflies. Seasonal vegetable crops enhance habitat complexity and comprise brinjal (*Solanum melongena*), broccoli (*Brassica oleracea* var. *italica*), beans (*Phaseolus* spp.), and tomatoes (*Solanum lycopersicum*),

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Table 1. Checklist of butterfly species and habitat recorded from the APC College campus during the study period.

Family	Common Name	Scientific Name	Abundance (Mean + SD)				Habitat*
			NOV	DEC	JAN	FEB	
Papilionidae	Tailed Jay	*Graphium agamemnon*	9 ± 2.73	4 ± 0.88	7 ± 1.84	3 ± 0.79	OG, MG, GR, SH, WL
	Common Rose	*Pachliopta aristolochiae*	4 ± 1.58	1 ± 0.27	ND	ND	OG, MG, GR, WL
	Common Mime	*Papilio clytia*	20 ± 3.56	9 ± 1.88	11 ± 3.19	ND	OG, MG, SH, WL
	Common Mormon	*Papilio polytes*	24 ± 6.43	12 ± 2.83	24 ± 4.24	10 ± 2.33	BU, OG, MG, GR, SH
	Common Lime	*Papilio demoleus*	22 ± 5.25	16 ± 3.11	14 ± 2.35	3 ± 0.73	BU, OG, MG, GR, SH, WL
Pieridae	Common Albatross	*Appias albina*	12 ± 2.75	15 ± 2.47	22 ± 4.69	14 ± 3.38	BU, OG, MG, GR, SH
	Striped Albatross	*Appias olferna*	1 ± 0.25	4 ± 1.15	3 ± 0.75	ND	OG, MG, GR, WL
	Common Emigrant	*Catopsilia pomona*	9 ± 1.48	4 ± 0.88	13 ± 2.92	7 ± 1.19	BU, OG, MG, GR, SH, WL
	Common Gull	*Cepora nerissa*	7 ± 1.75	ND	ND	ND	OG, MG, GR, SH
	Common Grass Yellow	*Eurema hecabe*	22 ± 4.23	13 ± 2.82	10 ± 2.19	12 ± 2.39	BU, OG, MG, GR, SH, WL
	Three spot Grass Yellow	*Eurema blanda*	15 ± 3.07	16 ± 3.87	12 ± 2.16	7 ± 1.33	OG, MG, GR, SH
	Cabbage White	*Pieris canidia*	11 ± 2.28	3 ± 0.58	4 ± 0.99	8 ± 1.25	BU, OG, MG, GR
	Mottled Emigrant	*Catopsilia pyranthe*	13 ± 3.29	8 ± 1.47	ND	2 ± 0.53	BU, OG, MG, GR, SH, WL
	Common Jezebel	*Delias eucharis*	25 ± 5.92	8 ± 1.58	10 ± 1.82	8 ± 2.20	OG, MG, SH
	Psyche	*Leptosia nina*	14 ± 2.99	12 ± 2.74	7 ± 1.65	ND	OG, MG, GR, SH, WL
Nymphalidae	Plain Tiger	*Danaus chrysippus*	7 ± 1.69	13 ± 3.00	2 ± 0.39	4 ± 0.98	BU, OG, MG, GR, SH, WL
	Blue Tiger	*Tirumala limniace*	3 ± 0.58	ND	ND	ND	OG, MG, GR, SH, WL
	Striped Tiger	*Danaus genutia*	19 ± 5.13	7 ± 1.56	12 ± 3.10	10 ± 2.48	BU, OG, MG, GR, SH, WL
	Common Crow	*Euploea core*	1 ± 0.27	2 ± 0.54	1 ± 0.18	ND	BU, OG, MG, GR, SH, WL
	Great Eggfly	*Hypolimnas bolina*	2 ± 0.40	3 ± 0.57	2 ± 0.42	ND	BU, OG, MG, GR, SH
	Dark Evening Brown	*Melanitis phedima*	3 ± 0.73	5 ± 1.33	4 ± 0.64	ND	GR, SH, WL
	Common Fourring	*Ypthima huebneri*	5 ± 0.76	4 ± 0.83	3 ± 0.45	4 ± 1.14	OG, GR, SH, WL
	Grey Pansy	*Junonia atlites*	18 ± 5.03	8 ± 1.67	3 ± 0.72	ND	OG, MG, GR, SH
	Lemon Pansy	*Junonia lemonias*	9 ± 1.68	5 ± 0.80	4 ± 0.86	6 ± 1.10	BU, OG, MG, GR, SH
	Peacock Pansy	*Junonia almana*	13 ± 3.24	1 ± 0.15	3 ± 0.54	2 ± 0.47	OG, MG, GR, SH, WL
	Common Palmfly	*Elymnias hypermnestra*	2 ± 0.34	3 ± 0.76	2 ± 0.57	1 ± 0.20	OG, MG, SH, WL
	Common Bushbrown	*Mycalesis perseus*	3 ± 0.60	5 ± 0.96	ND	ND	MG, GR, SH, WL
	Tawny Coster	*Acraea violae*	2 ± 0.47	2 ± 0.56	4 ± 0.87	2 ± 0.37	BU, OG, MG, GR, SH, WL

DOI: https://doi.org/10.52756/ijerr.2025.v48.003

Lycaenidae	Long-banded Silverline	*Cigaritis lohita*	4 ± 1.06	2 ± 0.39	ND	ND	OG, MG, SH
	Common Peirrot	*Castalius rosimon*	9 ± 2.38	2 ± 0.49	1 ± 0.25	2 ± 0.35	BU, OG, MG, SH
	Pale Grass Blue	*Pseudozizeeria maha*	26 ± 5.96	27 ± 7.38	15 ± 3.46	21 ± 4.74	OG, GR, SH, WL
	Lesser Grass Blue	*Zizina otis*	18 ± 4.06	15 ± 3.36	13 ± 3.36	15 ± 2.93	OG, GR, SH, WL
	Babul Blue	*Azanus ubaldus*	20 ± 5.15	12 ± 2.69	12 ± 3.40	5 ± 1.17	OG, MG, SH
	Common Oakblue	*Arhopala micale*	7 ± 1.67	11 ± 1.84	13 ± 3.34	5 ± 1.22	MG, SH, WL
Hesperiidae	Common Redeye	*Matapa aria*	4 ± 0.87	6 ± 1.73	2 ± 0.46	ND	OG, MG, SH
	Oriental Palm Bob	*Suastus gremius*	2 ± 0.59	4 ± 1.08	ND	1 ± 0.16	OG, MG, GR, SH

***Built-up area (BU):** Concrete buildings, basketball court, paved spaces; **Ornamental Garden (OG):** Flower beds, ornamental plants, vegetable plants, decorative patches; **Medicinal Garden (MG):** Medicinal plants, herbal garden; **Grassland (GR):** Grass fields, open grassy patches; **Shrubland (SH):** Bushes, low shrubs; **Wetland (WL):** Pond, wet grass near pond, moist edges

Figure 2. Flower blooming in January within the Acharya Prafulla Chandra College campus that serves as a nectar source for butterfly species.

all of which offer potential larval host plants or additional nectar sources, and an advantageous environment for butterfly diversity and abundance.

Species documentation and enumeration

The whole college campus was investigated using direct search and opportunistic sighting techniques from early morning to late afternoon every day, spanning four months from November to March of 2023-2024, and counted in the field. Daily data were converted to weekly and monthly formats as needed. Identification of species was made using Kehimkar's (2008) field guide in the field, and photographed as much as possible from many angles using a digital camera or cell phone without capturing specimens. All scientific and common English names adhered to the list of Varshney & Smetacek (2015).

Data Analyses

Collected monthly data were statistically analyzed for normality and homogeneity to assess the appropriateness of parametric tests. Thereafter, the Kruskal–Wallis H-test was utilized for non-parametric comparisons of species abundance across months. For each documented species, Relative Abundance (RA), Relative Frequency (RF), Relative Density (RD), and Importance Value Index (IVI) were computed to evaluate their relative dominance within the assemblage. The community structure was analysed using the Shannon–Wiener diversity index (H′), Simpson's dominance index (1–D), Pielou's evenness (J′), and Margalef's richness index (d). Sampling adequacy was assessed by individual rarefaction analysis, and a rank-abundance curve was generated to illustrate species distribution patterns. Monthly fluctuations in assemblages were analysed by cluster analysis using UPGMA method and Bray–Curtis similarity. In addition to recording and converting family-wise abundances to percentages, Non-metric Multidimensional Scaling (NMDS) with Bray–Curtis similarity was used to evaluate habitat similarity (Bhargava, 2009).

Result

The Kruskal–Wallis test showed butterfly abundance varied significantly ($Hc = 13.99$, $p = 0.0029$) over the four months. Post-hoc analysis using Dunn's test

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indicated that January had significantly higher abundance than November (p = 0.0209), while February had lower abundance compared with both November (p = 0.00024) and December (p = 0.0394). No statistically significant variations were found between December and January or between January and February.

A checklist of all documented species, including their monthly abundances and habitat types, is presented in Table 1.

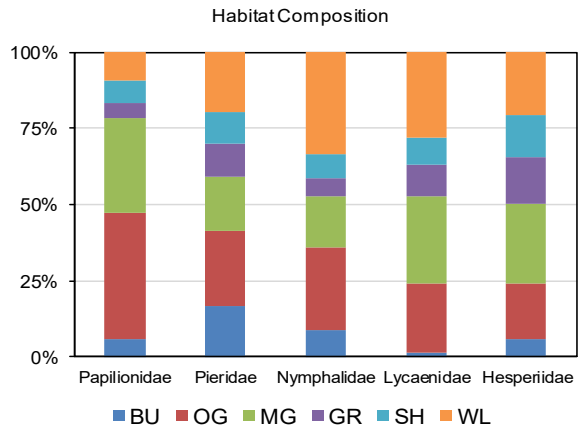

Figure 3. Comparison of butterfly family composition across habitat categories, illustrating variation in abundance patterns.

Habitat distribution of butterfly families varied considerably across the campus. Ornamental gardens supported the highest abundance for 34.6% of the total. Medicinal gardens also harbored a high proportion of butterflies (28.4%), with Lycaenidae (32.4%) and Papilionidae (33.1%) being dominant (Fig. 3). In contrast, built-up areas contributed only 7.9% of the total abundance, where Pieridae were predominant.

For diversity indices higher values of Shannon (H), and Simpson (1–D), Margalef richness (d) during November and December indicate greater species richness and diversity in the early winter period, whereas the decline in January and February suggests reduced colonization or resource availability (Table. 2). In contrast, Pielou's Evenness remained relatively stable (0.78–0.82), reflecting a fairly uniform distribution of individuals among species despite seasonal shifts in richness.

Table 2. Diversity indices of butterfly communities across different sampling months.

Diversity Indices	NOV	DEC	JAN	FEB
Taxa_S	36	34	32	26
Simpson_1-D	0.9602	0.9576	0.9526	0.945
Shannon_H	3.355	3.323	3.224	3.062
Evenness_e^H/S	0.7957	0.8163	0.7857	0.8217
Margalef	5.879	5.93	5.652	4.851

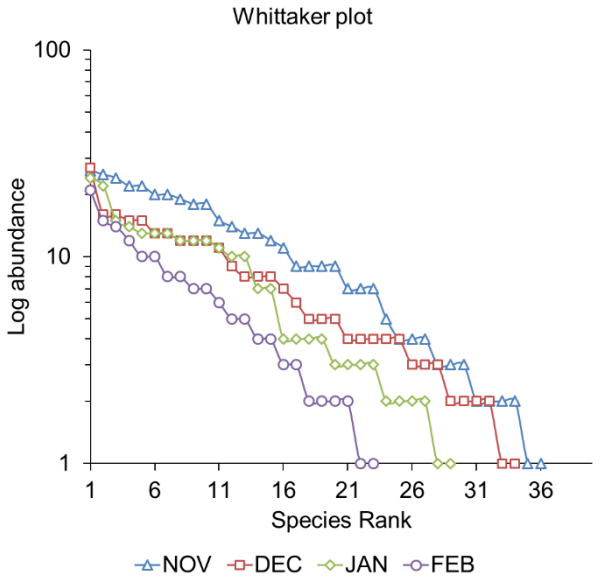

Figure 4. Whittaker rank–abundance plot of butterfly communities representing species dominance and evenness across the study site.

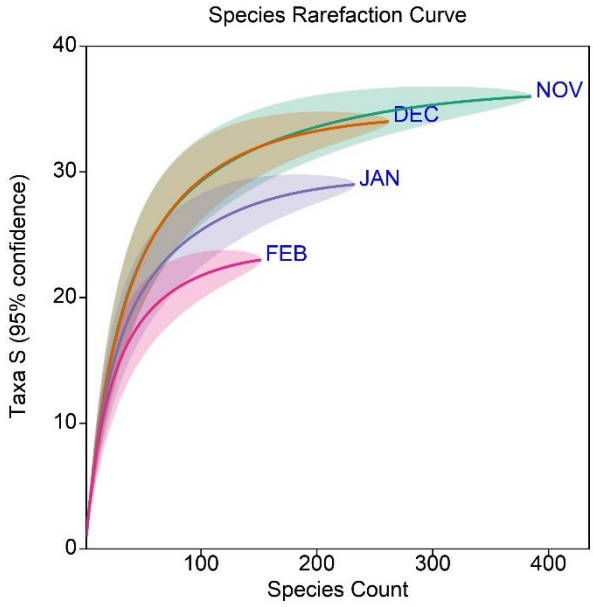

Figure 5. Sample-based rarefaction curve showing the cumulative increase in butterfly species richness with sampling effort in the study area.

The Whittaker rank-abundance curves constructed from monthly average species abundance (Fig. 4) exhibited significant seasonal change in butterfly assemblages. Species richness peaked in November with 36 species and relatively high evenness, whereas December, with 34 species, saw a more pronounced decrease in ranks, suggesting increased dominance. February exhibited the lowest species richness (22 species) with the most pronounced slope, indicating significant dominance and limited presence of unusual taxa. Individual rarefaction curves (Fig. 5) involving monthly data also corroborated these tendencies, with

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November exhibiting the highest species richness (36 species), December and January demonstrating intermediate values, and February revealing the lowest species richness, accompanied by early curve saturation. Non-overlapping confidence intervals between November and February indicated considerable seasonal contrasts in richness (Simonson et al., 2001; Hardersen & Corezzola, 2014).

The NMDS ordination (stress = 0.15, suggesting good fit) revealed distinct segregation of butterfly assemblages among habitats (Fig. 8). Built-up areas (BU) and Shrubland (SH) formed distinct separate clusters, indicating unique community compositions, while Ornamental Garden (OG), Medicinal Garden (MG), and Grassland (GR) showed considerable overlap, suggesting shared floral and host plant resources. Wetland (WL) occupied an intermediate position with partial overlap, suggesting transitional assemblages (Addo-Fordjour et al., 2015).

Two-way cluster analysis of butterfly assemblages across the four winter months (November–February) revealed distinct patterns of species association and temporal grouping (Fig. 7). The dendrogram of species clustered taxa with similar abundance profiles, while the heatmap gradient (blue to red) captured variation in monthly occurrence and abundance intensity. Species such as *Papilio polytes*, *Delias eucharis*, *Danaus genutia*, and *Eurema hecabe* exhibited higher abundance values (yellow–red zones), reflecting their dominance across months. Conversely, species like *Suastus gremius*, *Melanitis phedima* and *Matapa aria* were represented in lower abundances (blue–green zones), indicating restricted or sporadic occurrence. At the temporal scale, November and January assemblages were closely clustered, while December formed a distinct intermediate group, and February stood apart, indicating marked compositional shifts. November and December supported broader distributions of taxa, whereas February was characterized by low abundance across most species, as reflected by the dominance of cooler heatmap shades (Weibull et al., 2000).

Discussion

Based on total abundance, butterfly community of the campus was dominated by Pieridae (34%), followed by Lycaenidae (24.7%), Nymphalidae (20.7%), Papilionidae (18.7%), and least represented by Hesperiidae (1.8%). Although the number of Nymphalid Butterflies were highest, with 13 species consistently prevailing throughout all months, reaching their peak in November (Fig. 3), followed by Pieridae, whereas Papilionidae, Lycaenidae, and Hesperiidae exhibited relatively lower species richness. The progressive decrease from November to February suggests a seasonal impact on butterfly variety, possibly influenced by floral availability and environmental conditions (Abrahamczyk et al., 2011).

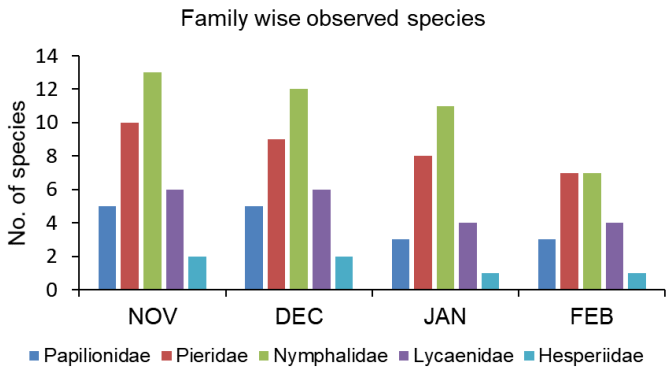

Figure 6. Family-wise distribution of butterfly species recorded from the APC College campus, showing number of species and individuals observed in each family.

The Importance Value Index (IVI) study revealed unique patterns of prevalence and scarcity within the butterfly assemblage (Table 3). Some species, like *Pseudozizeeria maha*, *Papilio polytes*, *Appias albina*, *Zizina otis* and *Eurema hecabe*, had the highest IVI scores. This shows that they were the most common, had a wider range of habitats, and were the most important in the research area. A few taxa, like *Pachliopta aristolochiae*, *Tirumala limniace*, *Cepora nerissa* and *Euploea core*, had low IVI values, which means they were rare or only appeared sometimes in the collection. The presence of dominating, sub-dominant, and rare categories indicates a moderately structured community in which a select few taxa significantly influence overall assemblage structure, but several others remain at reduced abundances. Such distributional patterns are typical of butterfly communities in heterogeneous habitats, where resource availability, host-plant specificity, and seasonal factors regulate relative success of species (Putri & Setiawan, 2021). The calculated values of Relative Density (RD), Relative Frequency (RF), and Relative Abundance (RA) highlighted the contribution of individual species to the community structure and provided insights into their dominance and ecological significance, as shown in Table 3.

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Table 3. Importance Value Index (IVI) of butterfly species recorded in the study area, indicating their ecological dominance, rank and status of distribution pattern.

Sl. No	Scientific Names	RA(%)	RD(%)	RF(%)	IVI =(RA+RD+RF)%	Rank	Dominance Status
1	*Graphium agamemnon*	2.23	2.23	3.28	7.74	19	Sub-dominant
2	*Pachliopta aristolochiae*	0.48	0.48	1.64	2.61	34	Rare
3	*Papilio clytia*	3.88	3.88	2.46	10.21	12	Dominant
4	*Papilio polytes*	6.78	6.78	3.28	16.84	2	Dominant
5	*Papilio demoleus*	5.33	5.33	3.28	13.94	6	Dominant
6	*Appias albina*	6.10	6.10	3.28	15.49	3	Dominant
7	*Appias olferna*	0.78	0.78	2.46	4.01	28	Rare
8	*Catopsilia pomona*	3.20	3.20	3.28	9.67	13	Sub-dominant
9	*Cepora nerissa*	0.68	0.68	0.82	2.18	35	Rare
10	*Eurema hecabe*	5.52	5.52	3.28	14.33	5	Dominant
11	*Eurema blanda*	4.84	4.84	3.28	12.97	8	Dominant
12	*Pieris canidia*	2.52	2.52	3.28	8.32	15	Sub-dominant
13	*Catopsilia pyranthe*	2.23	2.23	2.46	6.92	21	Sub-dominant
14	*Delias eucharis*	4.94	4.94	3.28	13.16	7	Dominant
15	*Leptosia nina*	3.20	3.20	2.46	8.85	14	Sub-dominant
16	*Danaus chrysippus*	2.52	2.52	3.28	8.32	15	Sub-dominant
17	*Tirumala limniace*	0.29	0.29	0.82	1.40	36	Rare
18	*Danaus genutia*	4.65	4.65	3.28	12.58	10	Dominant
19	*Euploea core*	0.39	0.39	2.46	3.23	31	Rare
20	*Hypolimnas bolina*	0.68	0.68	2.46	3.82	29	Rare
21	*Melanitis phedima*	1.16	1.16	2.46	4.78	26	Rare
22	*Ypthima huebneri*	1.55	1.55	3.28	6.38	22	Sub-dominant
23	*Junonia atlites*	2.81	2.81	2.46	8.08	17	Sub-dominant
24	*Junonia lemonias*	2.33	2.33	3.28	7.93	18	Sub-dominant
25	*Junonia almana*	1.84	1.84	3.28	6.96	20	Sub-dominant
26	*Elymnias hypermnestra*	0.78	0.78	3.28	4.83	25	Rare
27	*Mycalesis perseus*	0.78	0.78	1.64	3.19	32	Rare
28	*Acraea violae*	0.97	0.97	3.28	5.22	24	Sub-dominant
29	*Cigaritis lohita*	0.58	0.58	1.64	2.80	33	Rare
30	*Castalius rosimon*	1.36	1.36	3.28	5.99	23	Sub-dominant
31	*Pseudozizeeria maha*	8.62	8.62	3.28	20.53	1	Dominant
32	*Zizina otis*	5.91	5.91	3.28	15.10	4	Dominant
33	*Azanus ubaldus*	4.75	4.75	3.28	12.77	9	Dominant
34	*Arhopala micale*	3.49	3.49	3.28	10.26	11	Dominant
35	*Matapa aria*	1.16	1.16	2.46	4.78	26	Rare
36	*Suastus gremius*	0.68	0.68	2.46	3.82	29	Rare

These results suggest that butterfly abundance was highest during mid-winter (December–January), when ornamental flowers such as chrysanthemum, dahlia, marigold, and rose were in bloom. However, by February, as floral resources diminished, butterfly abundance sharply declined.

The rarefaction and Whittaker plot suggested the strong influence of seasonal environmental dynamics on butterfly community richness. The elevated diversity observed in November coincides with favorable post-monsoon conditions, including higher floral availability and moderate climatic conditions, which collectively enhance habitat suitability and resource heterogeneity.

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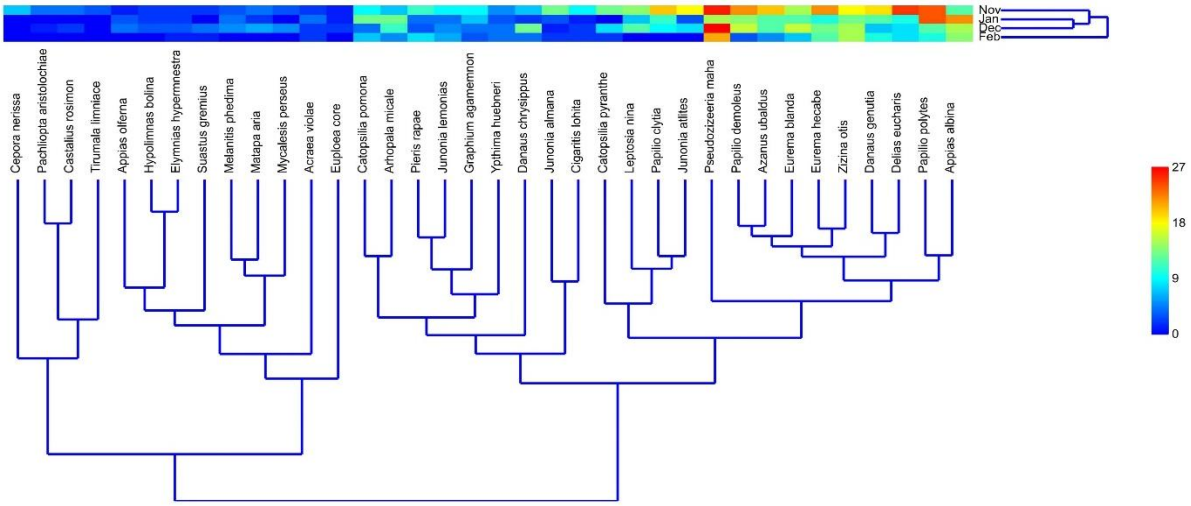

Figure 7. Cluster dendrogram of butterfly communities showing similarity patterns among different sampling units based on species composition.

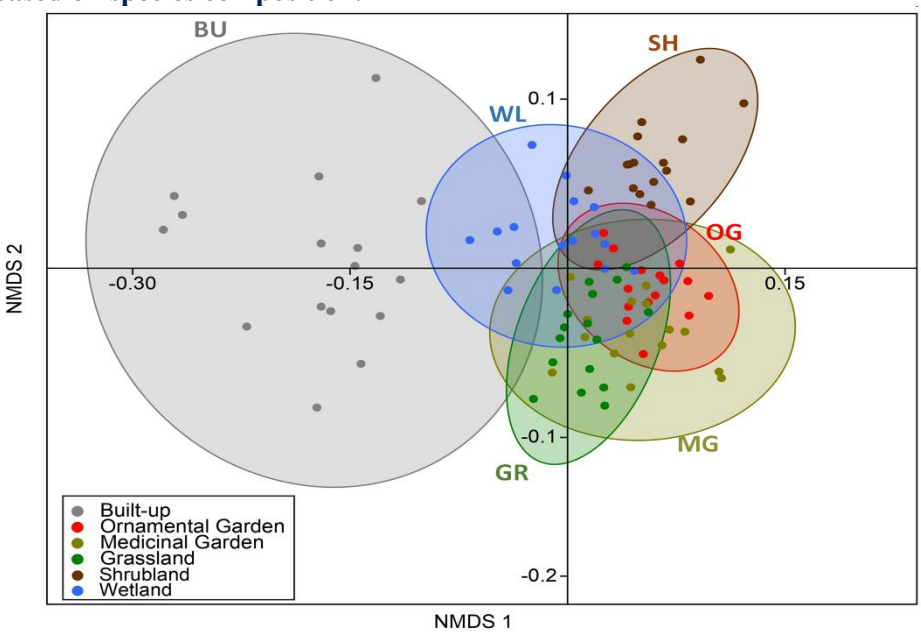

Figure 8. Non-metric multidimensional scaling (NMDS) ordination depicting the similarity of butterfly communities among six habitat types: Built-up (BU), Ornamental Garden (OG), Medicinal Garden (MG), Grassland (GR), Shrubland (SH) and Wetland (WL).

Figure 9. Some representatives (a) Plain Tiger, (b) Stripped Albatross, (c)Tailed Jay, (d) Grey Pansy, (e) Commander, (f) Common Jezebel, (g) Lemon Pansy, (h) Long-banded Silverline, (i) Redeye, (j) Psyche, (k) Common Lime, (l) Blue Tiger, (m) Common Rose, (n) Common Mime, (o) Common Mormon.

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December and January, though still diverse, exhibited a progressive decline, reflecting the onset of seasonal stress. The lowest richness in February suggests that winter conditions impose strong ecological constraints, such as reduced nectar resources, lower temperatures, and shortened photoperiods, which restrict the activity and survival of many butterfly taxa (Kunte, 2008; Ashton et al., 2015; Biswas et al., 2019).

The two-way cluster analysis highlighted both taxonomic and seasonal structuring of butterfly communities in the Acharya Prafulla Chandra College garden. Species clustering suggests the coexistence of ecologically similar taxa sharing resource niches, such as *Danaus* and *Papilio* spp., which thrived due to the availability of nectar-rich flowers during peak blooming. The strong grouping of November and January assemblages indicates that despite temporal differences, both months maintained comparable community structures, likely due to overlapping flowering phenology and stable nectar availability (Naik et 2022).

Overall, the clustering approach provided a robust visualization of community dynamics, demonstrating how post-monsoon resource abundance fosters species-rich, even assemblages, while late winter imposes selective filters leading to dominance by a few tolerant taxa. These findings emphasize the importance of maintaining diverse nectar sources and larval host plants within urban green spaces to sustain butterfly diversity year-round (Hussain et al., 2011).

Habitat heterogeneity drives distribution of butterflies across the college campus. Built-up areas (BU) favor generalist butterfly such as *Eurema hecabe* (Pieridae) and *Danaus chrysippus* (Nymphalidae). Ornamental Gardens (OG) sustain higher numbers of lycaenids and papilionids, including *Jamides celeno* and *Papilio polytes*, owing to the availability of nectar-rich ornamental plants and diverse larval host species. The Medicinal Garden (MG), enriched with specific host plants, supports specialist taxa such as *Zizina otis* (Lycaenidae) and *Borbo cinnara* (Hesperiidae), which depend on particular foliage and microhabitats. Grasslands (GR) harbor open-area Pierids and Nymphalids like *Catopsilia pomona* (Pieridae) and *Junonia atlites* (Nymphalidae) Shrublands (SH), being structurally complex, create shaded microhabitats and dense thickets that attract shade-tolerant groups like satyrids, including *Mycalesis perseus*. Finally, Wetlands (WL) serve as important habitats for danaids and pierids, with species such as *Danaus genutia* and *Appias albina* utilizing moist edges and mud puddling sites for essential mineral uptake (Farhat et al., 2014).

These habitat-specific relationships show that specialised groups (like Lycaenidae, Hesperiidae) are closely linked to specific niches, whereas generalist families (like Pieridae and Nymphalidae) predominate across a variety of habitats. Preserving diverse habitats in semi-urban landscapes is vital for maintaining butterfly richness and their ecological functions (Mukherjee et al., 2015). A significant seasonal fluctuation in abundance and diversity and species richness confirms that community structure was more diverse and even during post-monsoon months compared to peak winter. Similar comparable seasonal declines have been reported in tropical and subtropical butterfly communities, where post-monsoon months support peak diversity due to high resource abundance, while winter assemblages are dominated by a few tolerant species (Ramírez-Restrepo & MacGregor-Fors, 2017; Forister et al., 2019).

Conclusion

In the present study, a total of 36 butterfly species were recorded from Acharya Prafulla Chandra College campus and its surroundings, with varying relative abundance across the months. The maximum number of species was represented by the family Nymphalidae, followed by Pieridae, Lycaenidae, Hesperiidae and Papilionidae. Species richness and abundance were found to be highest during the post-monsoon month of November, while the lowest values occurred in the late winter month of February. Such patterns underscore the role of climatic and resource seasonality in shaping butterfly assemblages, with potential implications under ongoing climate variability. Sustaining floral resources and habitat heterogeneity during the dry winter months may be crucial for maintaining butterfly diversity at local scales. Proper conservation measures are also necessary to keep the college area a safe place for butterflies and to protect its role as a healthy campus ecosystem.

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Conflict of Interest

None

References

Abrahamczyk, S., Kluge, J., Gareca, Y., Reichle, S., & Kessler, M. (2011). The influence of climatic

seasonality on the diversity of different tropical pollinator groups. *PLoS ONE, 6*(11), e27115. https://doi.org/10.1371/journal.pone.0027115

Addo-Fordjour, P., Osei, B. A., & Kpontsu, E. A. (2015). Butterfly community assemblages in relation to human disturbance in a tropical upland forest in Ghana, and implications for conservation. *Journal of Insect Biodiversity, 3*(6), 1–18.

Antil, J., Bhat, C.G., Tripathi, P., & Kanaujia, A. (2025). Butterflies and their contribution in agro-forestry. Int. J. Adv. Res., 13(02), 1203-1213.

Ashton, L. A., Barlow, H. S., Nakamura, A., & Kitching, R. L. (2015). Diversity in tropical ecosystems: The species richness and turnover of moths in Malaysian rainforests. *Insect Conservation and Diversity, 8*(2), 132–142. https://doi.org/10.1111/icad.12093

Bhargava, V. K. (2009). Assessing the potential role of Coleoptera (Insecta) as bioindicators in Simbalbara Wildlife Sanctuary, Himachal Pradesh (Doctoral dissertation, Saurashtra University).

Biswas, S. J., Patra, D., Roy, S., Giri, S. K., Pal, S., & Hossain, A. (2019). Butterfly diversity throughout Midnapore urban area in West Bengal, India. *Journal of Threatened Taxa, 11*(14), 14816–14826. https://doi.org/10.11609/jott.4759.11.14.14816-14826

Bonebrake, T. C., Ponisio, L. C., Boggs, C. L., & Ehrlich, P. R. (2010). More than just indicators: A review of tropical butterfly ecology and conservation. *Biological Conservation, 143*(8), 1831–1841. https://doi.org/10.1016/j.biocon.2010.04.044

Dar, S. A., Mir, G. M., Parry, M. A., Ahmad, S. B., Ganie, M. A., Raja, T. A., & Parry, S. H. (2016). Diversity and richness indices and the Whittaker plot value of insect pollinators of Peach *Prunus persica* in landscapes of temperate India. *Academic Journal of Entomology, 9*(4), 62–73.

Farhat, Y. A., Janousek, W. M., McCarty, J. P., Rider, N., & Wolfenbarger, L. L. (2014). Comparison of butterfly communities and abundances between marginal grasslands and conservation lands in the eastern Great Plains. *Journal of Insect Conservation, 18*(2), 245–256. https://doi.org/10.1007/s10841-014-9647-1

Forister, M. L., Pelton, E. M., & Black, S. H. (2019). Declines in insect abundance and diversity: We know enough to act now. *Conservation Science and Practice, 1*(8), e80. https://doi.org/10.1111/csp2.80

Ghazanfar, M., Malik, M.F., Hussain, M., Iqbal, R., & Younas, M. (2016). Butterflies and their contribution in ecosystem: A review. *Journal of Entomology and Zoology Studies, 4*(2), 115-118

Hanberry, B. B. (2025). Potential expanded pollinator distributions in North America under future climate. *Ecological Solutions and Evidence*, *6*(2), e70025. https://doi.org/10.1002/2688-8319.70025

Hardersen, S., & Corezzola, S. (2014). Plot-based butterfly surveys: Statistical and methodological aspects. *Journal of Insect Conservation, 18*(6), 1171–1183. https://doi.org/10.1007/s10841-014-9725-4

Hussain, K. J., Ramesh, T., Satpathy, K. K., & Selvanayagam, M. (2011). Seasonal dynamics of butterfly population in DAE campus, Kalpakkam, Tamil Nadu, India. *Journal of Threatened Taxa, 3*(1), 1401–1414. https://doi.org/10.11609/JoTT.o2488.1401-14

Jaeger, S., Freedman, M., Alexander, C., Hilpman, E., Weber, M., & LoPresti, E. (2025). Increased reliance on diurnal pollination in a geographically and morphologically atypical sand verbena. *Journal of Pollination Ecology*, *38*, 58–75. https://doi.org/10.26786/1920-7603(2025)824

Kehimkar, I. (2008). *The book of Indian butterflies*. Bombay Natural History Society.

Kunte, K. (2000). *Butterflies of Peninsular India*. Universities Press.

Kunte, K. (2008). Competition and species diversity: Removal of dominant species increases diversity in Costa Rican butterfly communities. *Oikos, 117*(1), 69–76. https://doi.org/10.1111/j.2007.0030-1299.16125.x

Mukherjee, S., Banerjee, S., Saha, G. K., Basu, P., & Aditya, G. (2015). Butterfly diversity in Kolkata, India: An appraisal for conservation management. *Journal of Asia-Pacific Biodiversity, 8*(3), 210–221. https://doi.org/10.1016/j.japb.2015.09.004

Naik, D., Rao, R. S. P., Kunte, K., & Mustak, M. S. (2022). Ecological monitoring and indicator taxa: Butterfly communities in heterogeneous landscapes of the Western Ghats and Malabar coast, India. *Journal of Insect Conservation, 26*(1), 107–119. https://doi.org/10.1007/s10841-021-00366-0

Putri, T. A., & Setiawan, H. (2021). Diversity of butterflies (Hexapoda: Lepidoptera: Rhopalocera) around campus 4 of Universitas Ahmad Dahlan.

Jurnal Riset Biologi dan Aplikasinya, 3(2), 54–62. https://doi.org/10.26740/jrba.v3n2.p54-62

Ramírez-Restrepo, L., & MacGregor-Fors, I. (2017). Butterflies in the city: A review of urban diurnal Lepidoptera. *Urban Ecosystems, 20*(1), 171–182. https://doi.org/10.1007/s11252-016-0579-4

Raut, N. B., & Pendharkar, A. (2010). Butterfly diversity in relation to season and habitat types in Tamhini, northern Western Ghats, India. *Journal of Threatened Taxa, 2*(2), 676–682. https://doi.org/10.11609/JoTT.o2170.676-82

Saraf, K. K., & Vijaykumar, K. (2020). An overview on Butterflies significance. *International Journal of Entomology Research, 5*(5), 97-104

Segre, H., Kleijn, D., Bartomeus, I., WallisDeVries, M. F., De Jong, M., Frank van der Schee, M., Román, J., & Fijen, T. P. (2023). Butterflies are not a robust bioindicator for assessing pollinator communities, but floral resources offer a promising way forward. *Ecological Indicators*, *154*, 110842. https://doi.org/10.1016/j.ecolind.2023.110842

Sharma, G., & Joshi, P. C. (2009). Diversity of butterflies (Lepidoptera: Rhopalocera) from Dholbaha dam (Distt. Hoshiarpur) in Punjab Shiwaliks, India. *Biological Forum, 1*(2), 11–14.

Simonson, S. E., Opler, P. A., Stohlgren, T. J., & Chong, G. W. (2001). Rapid assessment of butterfly diversity in a montane landscape. *Biodiversity & Conservation, 10*(8), 1369–1386. https://doi.org/10.1023/A:1016691026595

Thomas, J. A. (2005). Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. *Philosophical Transactions of the Royal Society B: Biological Sciences, 360*(1454), 339–357. https://doi.org/10.1098/rstb.2004.1585

Tiple, A. D., Khurad, A. M., & Dennis, R. L. H. (2007). Butterfly diversity in relation to a human-impact gradient on an Indian university campus. *Nota Lepidopterologica, 30*(1), 179–188.

Varshney, R. K., & Smetacek, P. (Eds.). (2015). *A synoptic catalogue of the butterflies of India*. Butterfly Research Centre, Bhimtal and Indinov Publishing. ISBN: 978-81-929826-4-9

Weibull, A. C., Bengtsson, J., & Nohlgren, E. (2000). Diversity of butterflies in the agricultural landscape: The role of farming system and landscape heterogeneity. *Ecography, 23*(6), 743–750. https://doi.org/10.1111/j.1600-0587.2000.tb00288.x

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